

Aermacchi MB-326

Airworthiness Certification



AIR-230 Airworthiness Branch
Federal Aviation Administration
Washington, D.C.
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Introduction – MB-326 Airworthiness Certification

This document provides information to assist in the airworthiness certification and safe civil operation of a MB-326 aircraft.

Attachment 1 provides a general overview of this document. Attachment 2 contains background information on the aircraft. Attachment 3 lists historic airworthiness issues with the MB 326 for consideration in the certification, operation, and maintenance of these aircraft. The list is not exhaustive, but includes our current understanding of risks that should be assessed during in the certification, operation, and maintenance of these aircraft. Concerns regarding particular issues may be mitigated in various ways. Some may be mitigated via the aircraft maintenance manual(s) or the aircraft inspection program. Others may be mitigated via operating procedures i.e., SOPs) and limitations, aircraft flight manual changes, or logbook entries

Not all issues in attachment 3 may apply to a particular aircraft given variations in aircraft configuration, condition, operating environment, or other factors. Similarly, circumstances with an aircraft may raise other issues not addressed by attachment 2 that require mitigation. Attachment 4 includes additional resources and references.

Attachment 1 – Overview of this Document

Purpose

This document is to provide all those involved in the certification, operation, and maintenance of the MB-326 aircraft with safety information and guidance to help assess and mitigate safety hazards for the aircraft. The existing certification procedures in FAA Order 8130.2, Airworthiness Certification of Aircraft and Related Products, do not account for many of the known safety concerns and risk factors associated with many high-performance former military aircraft. These safety concerns and risk factors associated with many high performance former military aircraft include—

- Lack of consideration of inherent and known design failures;
- Several single-point failures;
- Lack of consideration for operational experience, including accident data and trends;
- Operations outside the scope of the civil airworthiness certificate;
- Insufficient flight test requirements;
- Unsafe and untested modifications;
- Operations over populated areas (the safety of the non-participating public has not been properly addressed in many cases);
- Operations from unsuitable airports (i.e., short runways, Part 139 (commercial) airports);
- High-risk passenger carrying activities taking place;
- Ejection seat safety and operations not adequately addressed;
- Weak maintenance practices to address low reliability of aircraft systems and engines;
- Insufficient inspection schedules and procedures;
- Limited pilot qualifications, proficiency, and currency;
- Weapon-capable aircraft not being properly demilitarized, resulting in unsafe conditions;
- Accidents and serious incidents not being reported; and
- Inadequate accident investigation data.

Research of MB 326 Safety Data

The aircraft, relevant processes, and safety data are thoroughly researched and assessed. This includes—

- Aviation Safety (AVS) Safety Management System (SMS) policy and guidance;
- Historical military accident/incident data and operational history;
- Civil accident data;
- Safety risk factors;
- Interested parties and stakeholders (participating public, non-participating public, associations, service providers, air show performers, flying museums, government service providers, airport owners and operators, many FAA lines of business, and other U.S. Government entities);
- Manufacturing and maintenance implications; and
- Design features of the aircraft.

This Document

The document is a compilation of known safety issues and risk factors identified from the above research that are relevant to civil operations. This document is organized into four major sections:

- General airworthiness issues (grey section),
- Maintenance (yellow section),
- Operations (green section), and
- Standard operating procedures and best practices (blue section).

This document also provides background information on the aircraft and an extensive listing of resources and references.

How to Use the Document

This document was originally drafted as job aids intended to assist FAA field office personnel and operators in the airworthiness certification of these aircraft. As such, some of the phrasing implies guidance to FAA certification personnel. The job aids were intended to be used during the airworthiness certification process to help identify any issues that may hinder the safe certification, maintenance, or operation of the aircraft. The person performing the certification and the applicant would discuss the items in the job aid, inspect documents/records/aircraft, and mitigate any issues. This information would be used to draft appropriate operating limitations, update the aircraft inspection program, and assist in the formulation of adequate operating procedures. There are also references to requesting information from, or providing information to the person applying for an airworthiness certificate. We are releasing this document as drafted, with no further updates and revisions, for the sole purpose of communicating safety information to those involved in the certification, operation, and maintenance of these aircraft. The identified safety issues and recommended mitigation strategies are clear and can be considered as part of the certification, operation, and maintenance of the air aircraft.

Attachment 2—Background Information on the MB-326 Aircraft

The Aermacchi MB-326 is an Italian military trainer and light attack aircraft produced by Alenia Aermacchi of Varese, Italy. The MB-326 is of conventional configuration and all-metal construction. It has a low, straight wing with tip tanks and jet intakes in the roots, tricycle undercarriage, and accommodation for the student and instructor in tandem. The most significant revision was a redesign of the forward fuselage to raise the instructor's seat to allow visibility over and past the student pilot's head. The aircraft is fitted with the Rolls-Royce Viper engine, and several versions of this engine are used in different MB-326 versions and variants.

The first flight of the MB-326 took place December 10, 1957, and deliveries to the Italian Air Force commenced in 1962. A total of 761 were built. These trainers were also supplied to countries in Africa and South America, their sales being fueled by a growing need to replace older, propeller driven trainers. To further expand its customer base, Aermacchi soon produced the armed, two seat MB-326B and -326F. A stable and extremely maneuverable aircraft, the MB-326 was well suited for the close-support role. The MB-326 has since been replaced by newer training aircraft, and some the surplus airframes have been sold to private operators, most ending up in the United States. The largest operator of the type in the U.S. has been the National Test Pilot School in Mojave, California.



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Several versions and designations of the MB-326 exist, including:

- MB-326 (original production variant for Italy with the Rolls-Royce Viper 632 engine);
- MB-326B(version built for Tunisia);
- MB-326D (version built for Alitalia);
- MB-326E (version built for Italian Air Force);

- MB-326F (version built for Ghana);
- MB-326G (MB-326GB variant built for Argentina (Argentina's Naval Aviation), Zaire, and Zambia, MB-326GC variant built for Brazil, Togo, and Paraguay) (XT-26 and RT-26 Xavante are Brazilian Air Force designations);
- MB-326H (version built for Royal Australian Air Force);
- MB-326K (version built for South African Air Force, variants built for Zaire, Dubai, Ghana, and Tunisia);
- MB-326L (variants built for Dubai and Tunisia);
- MB326M (version built for South African Air Force), and
- MB326RM (version built for Italian Air Force).



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The MB-326's career has been successful in military terms, and continues to be successful today. Seven air forces currently use the aircraft. The MB-326 has the capability to carry a wide variety of United States and North Atlantic Treaty Organization (NATO) standard external stores in six wing hard points. At this time, the Federal Aviation Administration (FAA) registry lists 3 MB-326 aircraft. However, there is significant potential for the MB-326 population to grow in the United States because of the high number of stored airframes and imports, notably from South Africa and Brazil.

Specifications (MB-326)

General Characteristics

- Crew: two, student and instructor
- Length: 34 ft 11¼ in
- Wingspan: 34 ft 8 in

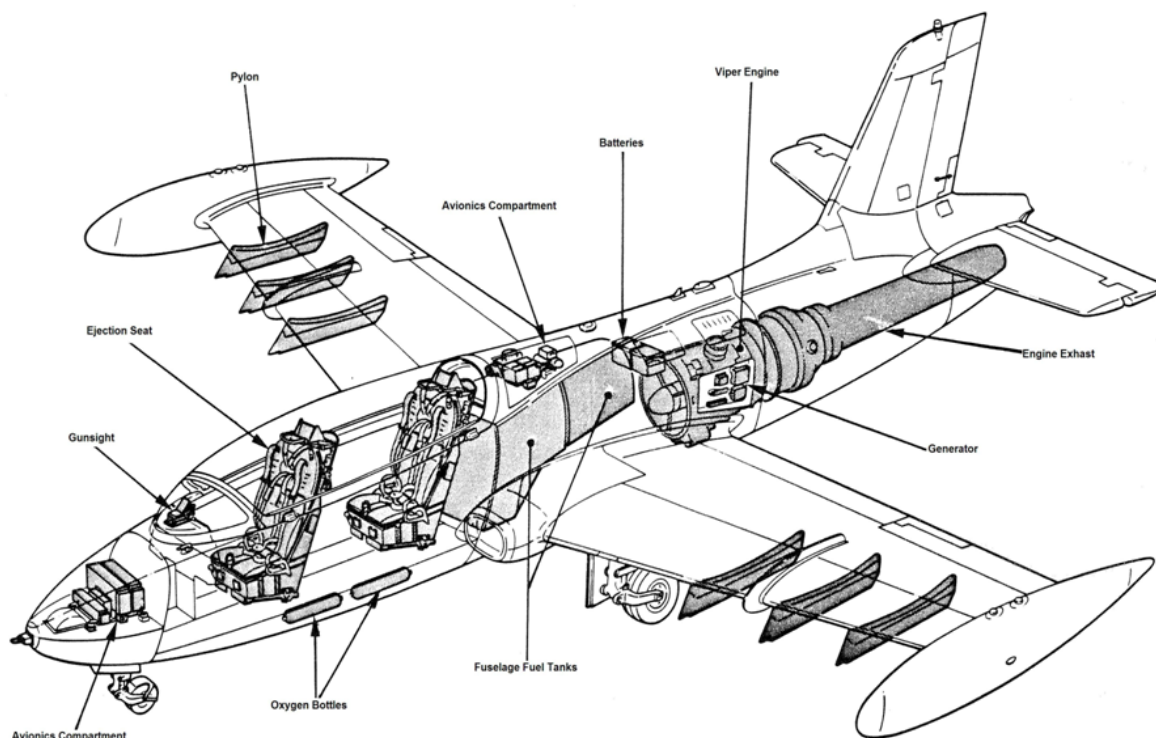
- Height: 12 ft 2½ in
- Wing area: 204.5 ft²
- Airfoil: NACA 64A-114
- Empty weight: 4,930 lb
- Loaded weight: 8,300 lb
- Maximum takeoff weight: 13,000 lb
- Powerplant: 1 x Rolls Royce Viper 20, 3,410 lb

Performance

- Never exceed speed: Mach 0.80 (500 knots)
- Maximum speed: 436 knots at 15,000 ft
- Stall speed: 79 knots
- Range: 950 NMI with large tip tanks at 38,000 ft
- Service ceiling: 41,000 ft
- Rate of climb: 4,400 ft/min
- Wing loading: 46.6 lb/ft²

Armament / Weapons and Related Systems

- Guns: provision for 2 × 12.7 mm Browning machine guns in under-wing pods
- Bombs: Up to 2000 lb of weapons on six hard-points, including gun-pods, bombs, and rockets



Source: 1T-MB326LT-1.

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Issue #	Issue(s)	Recommended Review, Action(s), and Coordination with Applicant	Notes, Action(s) Taken, and Disposition
MB-326 Preliminary and General Airworthiness Inspection Issues			
1.	Aircraft Familiarization	Become familiar with the aircraft before initiating the certification process. One of the first steps in any aircraft certification is to be familiar with the aircraft in question, in this case the MB-326. Such knowledge, including technical details are essential in establishing a baseline as the certification process moves forward.	
2.	Preliminary Assessment	Conduct a preliminary assessment of the aircraft to ascertain condition and general airworthiness.	
3.	Condition for Safe Operation	This is an initial determination by an FAA inspector or authorized Representative of the Administrator that the overall condition of an aircraft is conducive to safe operations. This refers to the condition of the aircraft relative to wear and deterioration. The FAA inspector will make an initial determination as to the overall condition of the aircraft. The aircraft items evaluated depend on information such as aircraft make, model, age, type, completeness of maintenance records of the aircraft, and the overall condition of the aircraft.	
4.	Main Safety Issues	Some of the general safety concerning the MB-326 that this document addresses include: <ul style="list-style-type: none"> ➤ Consideration of inherent and known design failures; ➤ Insufficient flight test requirements; ➤ Operations over populated areas - the safety of the non-participating public has not been properly addressed in many cases; ➤ Operations from unsuitable airports; ➤ High-risk passenger carrying activities take place. ➤ Ejection seat safety and operation; ➤ Weak maintenance practices to address low reliability of aircraft systems and engines; ➤ Limited pilot proficiency in many cases, and ➤ Weapon capable aircraft are certificated by the FAA but have not been demilitarized. 	
5.	Denial	If the aircraft does not meet the certification requirements and the special airworthiness certificate is denied, the FAA will provide a letter to the applicant stating the reason(s) for denial and, if feasible, identify which steps may be accomplished to meet the certification requirements. Should this occur, a copy of the denial letter will be attached to FAA Form 8130-6 and forwarded to AFS-750, and made a part of the aircraft's record.	
6.	Potential Reversion Back to Phase I	Notify the applicant that certain modifications to the aircraft will invalidate Phase II. These include: (a) structural modifications, (b) aerodynamic modifications, including externally mounted equipment except as permitted in the limitations issued, and (c) change of engine make, model, or power rating (thrust or horse power). The owner/operator may return the aircraft to Phase I in order to flight test specific items as required. However, major modifications such as those listed above may require new operating limitations.	
7.	Identify MB-326 Version and Sub-Variants	Identify the specific MB-326 version being certificated. There are major differences among MB-326 aircraft, not just in terms of engines but major systems and weapons capability. Note: The differences between the standard Italian Air Force MB-326 and an ex-Royal Australian Air Force (RAAF) or an ex-South African Air Force (SAAF) MB-326 can be significant.	
8.	Major Structural Components	Ask the applicant to identify and document the origin, condition, and traceability of major structural components.	

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9.	Airframe and Engine Data	<p>Ask applicants to provide the following:</p> <p>Airframe:</p> <ul style="list-style-type: none"> • Import country; • N-Number; • Manufacture year and serial number; • Airframe time and airframe cycles. <p>Engine:</p> <ul style="list-style-type: none"> • Type and variant; • Manufacture date and serial number; • Overhaul data, location, provider, and engine time & cycles. <p>Properly identifying the relevant and basic characteristics of the airframe and the engine will be useful in addressing the safety issues with the aircraft.</p>	
10.	T.O. 00-5-1 AF Technical Order System	Become familiar with T.O. 00-5-1 AF technical Order System, May 1, 2011. This document provides guidance in the USAF TO system, which guides much of the documentation associated with the T-33 aircraft. Note: NATO uses a similar system.	
11.	Aircraft Records	Request and review the applicable military and civil aircraft records, including aircraft and engine logbooks. For example, in cases involving ex-RAAF or ex-SAAF MB-326s, ask the applicant to produce that air force's records for the aircraft.	
12.	FAA Records Review	Review the existing FAA airworthiness and registration files (EDRS) and search the Program Tracking and Reporting Subsystem (PTRS) for safety issue(s) and incidents.	
13.	FAA Form 8100-1	<p>Use FAA Form 8100-1 to document the airworthiness inspection. Using this form facilitates the listing of relevant items to be considered, those items' nomenclature, any reference (that is, NATO manual; FAA Order 8130.2, Airworthiness Certification of Aircraft and Related Products; regulations) revision, satisfactory or unsatisfactory notes, and comments. Items to be listed include but are not limited to—</p> <ol style="list-style-type: none"> 1. FAA Form 8130-6; 2. § 21.193 of Title 14 of the Code of Federal Regulations (14 CFR); 3. FAA Form 8050-1; 4. 14 CFR § 45.11(a); 5. FAA Order 8130.2, paragraphs 4002a(7) and (10), 4002b(5), 4002b(6), 4002b(8), 4111c, and 4112a(2); 6. 14 CFR § 91.205; 7. § 91.417(a)(2)(i), airframe records and total time, overhaul; and 8. § 91.411/91.413, altimeter, transponder, altitude reporting, static system test. 	
14.	Functionality Check	Ask the applicant to prepare the aircraft for flight, including all preflight tasks, start-up, run-up, and taxi.	

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15.	Adequate MB-326 Manuals and Related Documentation	<p>Ensure the existence of a complete set of the applicable manuals (NATO, RAAF, SAAF), such as flight manuals, inspections and maintenance manuals, and engine manuals. An operator also needs to have the applicable technical orders (TO) to address known issues related to airworthiness, maintenance, and servicing. Note: The use of and reference to RAAF or SAAF manuals are made in this document because they represent an equivalent to the acceptable U.S. Air Force (USAF) or NATO references. Relevant MB-326 manuals include:</p> <ul style="list-style-type: none"> • Aermacchi M-326 KD C B T Z Aircraft Flight Manual - 1981 • Aermacchi M-326 Aircraft Flight Procedure Manual • Aermacchi M-326 Aircraft Emergency Procedure Manual • Aermacchi M-326 H Aircraft Maintenance Manual - Radio • Aermacchi M-326 H Aircraft Maintenance Manual - Instruments • Aermacchi M-326 GC Aircraft Maintenance Manual - Flight CRT • Aermacchi M-326 Aircraft Parts Catalog Manual - • Aermacchi M-326 KZ Aircraft Structural Manual - • Aermacchi M-326 KD C B T Z Aircraft Weapon Manual - 1980 • Aermacchi M-326 GB Aircraft Technical Brochure Manual 	
16.	Availability of Documents Listed in the Applicable Aircraft List of Applicable Publication Manual	Review the aircraft inspection program (AIP) to verify compliance with the applicable version of Aermacchi MB-326 aircraft list of applicable publication manuals or equivalent document. This document should contain the complete listing of all applicable NATO/Italian Air Force MB-326 TOs. Note: Where applicable, equivalent RAAF or SAAF documents such as engineering orders are acceptable.	
17.	Applicant/Operator Capabilities	Review the applicant's/operator's capabilities, general condition of working/storage areas, availability of spare parts, and equipment.	
18.	Scope and Qualifications for Restoration, Repairs or Maintenance	Familiarize yourself with the scope of the restoration, repairs, and maintenance conducted by or for the applicant.	
19.	Operational Risk Management (ORM)	Recommend an ORM-like approach be implemented by the MB-326 owner/operator. ORM employs a five-step process: (1) Identify hazards, (2) Assess hazards, (3) Make risk decisions, (4) Implement controls, and (5) Supervise.	
20.	Limiting Duration of Certificate	Refer to § 21.181 and FAA Order 8130.2, regarding the duration of certificates, which may be limited. An example would be to permit operations for a period of time to allow the implementation of a corrective action or changes in limitations. In addition, an ASI may limit the duration if there is evidence additional operational requirements may be needed at a later date.	
21.	Compliance With § 91.319(a)(1)	Inform the operator operations of the aircraft are limited under this regulation. The aircraft cannot be operated for any purpose other than the purpose for which the certificate was issued. For example, in the case of an experimental exhibition certificate, the certificate can be used for air show demonstrations, proficiency flights, and flights to and from locations where the maintenance can be performed. Such a certificate is NOT IN EFFECT for flights related to providing military services (that is, air-to-air gunnery, target towing, ECM simulation, cruise missile simulation, and air refueling). Also refer to <i>Military/Public Aircraft Operations</i> below.	

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22.	Multiple Certificates and Public Aircraft Operations, That Is, DOD Contracts. Also Refer to <i>Military Operations</i> Below.	In those cases involving multiple airworthiness certificates, ensure the applicant submits information describing how the aircraft configuration is changed from one to the other. This is important because, for example, some research and development (R&D) activities may involve equipment that must be removed to revert back to the Exhibition configuration. Moreover, the procedures should provide for any additional requirement(s), such as additional inspections, to address situations such as high-G maneuvering that could have an impact on the aircraft and/or its operating limitations. Similarly, removing equipment that could be considered part of a weapon system may be required (refer to <i>Demilitarization</i> below). All applications for an R&D certificate must adhere to FAA Order 8130.29, Issuance of a Special Airworthiness Certificate for Show Compliance and/or Research and Development Flight Testing. A similar process should be identified to revert back from public aircraft operations.	
23.	Demilitarization	Verify the aircraft has been adequately demilitarized. The MB-326 has a secondary mission as light attack. As such, it would be equipped with weapon systems. Removal of the gun pods alone, for example, does not suffice. Wiring, switches, and other subsystems need to be disabled as well. Safety issues with these systems include inadvertent discharge of flares, toxic chaff, electrical overloads of the aircraft electric system, danger of inadvertent release, structural damage, complex flight limitations, and harmful emissions. TO 00-80G-1, Make Safe Procedures for Public Static Display, dated November 30, 2002, can be used as a reference as well.	
24.	Federally Obligated Airport Access	Inform the operator that MB-326 operations may be restricted by airports because of safety considerations. As provided by Title 49 of the United States Code (U.S.C.) § 47107(a), a federally obligated airport may prohibit or limit any given type, kind, or class of aeronautical use of the airport if such action is necessary for the safe operation of the airport or necessary to serve the civil aviation needs of the public. Additionally, per FAA Order 5190.6, FAA Airport Compliance Manual, the airport should adopt and enforce adequate rules, regulations, or ordinances as necessary to ensure safety and efficiency of flight operations and to protect the public using the airport. In fact, the prime requirement for local regulations is to control the use of the airport in a manner that will eliminate hazards to aircraft and to people on the ground. In all cases concerning airport access or denial of access, and based on FAA Flight Standards Service safety determination, FAA Airports is the final arbiter regarding aviation safety and will make the determination (Director's Determination, Final Agency Decision) regarding the reasonableness of the actions that restrict, limit, or deny access to the airport (refer to FAA Docket 16-02/08, FAA v. City of Santa Monica, Final Agency Decision; FAA Order 2009-1, July 8, 2009; and FAA Docket 16-06-09, Platinum Aviation and Platinum Jet Center BMI v. Bloomington-Normal Airport Authority).	
25.	Environmental Impact (Noise)	Inform the operator that MB-326 operations may be restricted by airport noise access restrictions and noise abatement procedures in accordance with 49 U.S.C. § 47107. As a reference, refer to FAA Order 5190.6.	
26.	Operations Overseas	Inform the applicant/operator that MB-326 operations may be restricted and permission must be granted by foreign civil aviation authorities (CAA) within the scope of ICAO's Article 40 ICAO. The applicable CAA may impose any addition limitation as it deems necessary, and may expand upon the restrictions imposed by the FAA on the aircraft. In line with existing protocols, the FAA will provide the foreign aviation authority with any information, including safety information for consideration in evaluating whether to permit the operation of the aircraft in their country, and if so, under what conditions and/or restrictions. It is also noted that any operator offering to use a U.S. civil aircraft with an experimental certificate to conduct operations such as air-to-air combat simulations, electronic counter measures, target towing for aerial gunnery, and/or dropping simulated ordinances pursuant to a contract or other agreement with a foreign government or other foreign entity would not be doing so in accordance with any authority granted by the FAA as the State of Registry or State of the Operator.	
27.	2009 Crash of ZU-BEX	It is recommended that the accident report concerning the 2009 Lightning T5 ZU-BEX be reviewed in detail. This report, published by the South African CAA in August 2012, provides valuable insight into the consequences of operating complex and high-performance former military aircraft in an unsafe manner. The relevant issues identified in the report include (1) ignoring operational history and accident data, (2) inadequate maintenance practices, (4) granting extensions on inspections, (3) poor operational procedures, and (5) inadequate safety oversight. Many of the issues discussed and documented in the accident investigation report are directly relevant to safety topics discussed in this Hawker Hunter airworthiness review document. The South African CAA report can be found at http://www.caa.co.za/ .	

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MB-326 Maintenance Manual(s), Aircraft Inspection Program (AIP), and Servicing			
28.	Changes to Aircraft Inspection Program (AIP)	Consider whether the FAA-accepted AIP is subject to revisions to address safety concerns, alterations, or modifications to the aircraft. Section 91.415, Changes to Aircraft Inspection Programs, requires that “whenever the Administrator finds that revisions to an approved aircraft inspection program under § 91.409(f)(4) or § 91.1109 are necessary for the continued adequacy of the program, the owner or operator must, after notification by the Administrator, make any changes in the program found to be necessary by the Administrator.”	
29.	Maintenance Practices	In addition to any guidance provided by the manufacturer/military service(s), consider Advisory Circular (AC) 43.13-2, Acceptable Methods, Techniques, and Practices-Aircraft Alterations, and AC 43.13-1, Acceptable Methods, Techniques, and Practices-Aircraft Inspection and Repair, to verify safe maintenance practices.	
30.	Qualifications for Inspections	Ensure only FAA-certificated repair stations and FAA-certificated mechanics with appropriate ratings as authorized by 14 CFR § 43.3 perform inspections on the MB-326.	
31.	Modifications	Within the scope and intent of § 21.93, verify major changes do not create an unsafe condition and determine whether new operating limitations will be required. In addition, the information contained in appendix A to part 43 can be used as an aid. See <i>Potential Reversion Back to Phase I</i> above.	
32.	Adequate Maintenance Schedule and Program	Ensure the AIP follows NATO/RAAF/SAAF requirements as appropriate concerning inspections. Under NATO standards, for example, the proper reference would be 1T-MB326-6-1 (inspection schedule and replacement times) or a similar document. This is important when developing an inspection program under § 91.409. The inspection program must comply with both hourly and calendar inspection schedules. The only modifications to the military AIP should be related to the removal of military equipment and weapons. Deletions should be properly documented and justified. A 100-hour, 12-month inspection program under appendix D to part 43 may not be adequate for an aircraft like the MB-326.	
33.	Prioritize Maintenance Actions	Recommend the adoption of a risk management system that reprioritizes high-risk maintenance actions in terms of (a) immediate action, (b) urgent action, and (c) routine action. Also refer to <i>Recordkeeping, Tracking Discrepancies, and Corrective Action</i> below.	
34.	Recordkeeping, Tracking Discrepancies, and Corrective Action	Check applicant recordkeeping. The scope and content of §§ 43.9, 43.11, and 91.417 are acceptable. The USAF Form 781 process, the U.S. Navy’s Maintenance Action Form (MAF), or a NATO/RAAF/SAAF equivalent process will assist with recordkeeping and help verify acceptable levels of continued operational safety (COS) for this type of aircraft. Three types of maintenance write-ups can be found inside USAF Form 781: (1) an informational, that is, a general remark about a problem that does not require mitigation; (2) a red slash for a potentially serious problem; and (3) a red “X” highlighting a safety of flight issue that could result in an unsuccessful flight and/or loss of aircraft—no one should fly the aircraft until the issue is fixed. For more information on record keeping, refer to AC 43-9, Maintenance Records.	
35.	Qualifications of Maintenance Personnel	Check for appropriate qualifications, licensing, and type-specific training of personnel engaged in managing, supervising, and performing aircraft maintenance functions and tasks. The National Transportation Safety Board (NTSB) has found the use of non-certificated mechanics with this type of aircraft has been a contributing factor to accidents. Only FAA-certificated repair stations and FAA-certificated mechanics with appropriate ratings as authorized by § 43.3 perform maintenance on this aircraft.	
36.	Ground Support, Servicing, and Maintenance Personnel Recurrent Training	Recommend regular refresher training be provided to ground support, servicing, and maintenance personnel concerning the main safety issues surrounding servicing and flight line maintenance of the MB-326. Such a process should include a recurrent and regular review of the warnings, cautions, and notes listed in TO 1T-MB326-2-1, Technical Manual General Airplane. Note: Ejection seat safety is paramount.	
37.	Parts Storage and Management and Traceability	Recommend establishing a parts storage program that includes traceability of parts.	

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38.	Maintenance Records and Use of Tech Data	As required by FAA Order 8130.2, conduct a detailed inspection of maintenance records. Verify maintenance records reflect inspections, overhauls, repairs, time-in-service on articles, and engines. Ensure all records are current and appropriate technical data is referenced. This should not be a cursory review. Maintenance records are commonly poor or incomplete for imported aircraft. Refer to <i>Adequate MB-326 Manuals and Related Documentation</i> above.	
39.	Viper Airworthiness Directives	Recommend that the applicable Airworthiness Directives involving certificated versions of the Viper engine be considered ads part of the AIP. For example, see Docket No. 98-ANE-06-AD; Amendment 39-10940; AD 98-25-14 Rolls-Royce Viper Mk. 521, 522, 526 and 601 Series Engines, discussing several known safety issues, including BFCU failure.	
40.	"On Condition" Inspections	If "on condition" inspections are considered, adhere to the military/manufacture program and/or provide adequate data to justify that practice for the applicable part or component. "On condition" must reference an applicable standard (that is, inspect the fuel pump to an acceptable reference standard, not just "it has been working so far"). Each "on condition" inspection must state acceptable parameters. "On condition" inspections are not appropriate for all parts and components.	
41.	Airframe, Engine, and Component Replacement Intervals	Verify compliance with required replacement intervals as outlined in appropriate and most current NATO/RAAF/SAAF inspection guidance. If components are not replaced per the military guidance, ask for data to justify extensions. Applicants should establish and record time in service for all life-limited components and verify compliance with approved life limits. Set time limits for overrun of intervals and track cycles. Evaluate any overruns of inspection or maintenance intervals.	
42.	Inspect and Repair as Necessary (IRAN)	If IRAN is proposed, verify it is detailed and uses adequate technical data (that is, include references to acceptable technical data) and adequate sequence for its completion. An IRAN must have a basis and acceptable standards. It is not analogous to an "on condition" inspection. It must have an established level of reliability and life extension. An IRAN is not a homemade inspection program.	
43.	Combining Inspection Intervals Into One	Set time limits for overrun (flex) of inspection intervals.	
44.	Aircraft Storage and Returning the Aircraft to Service After Inactivity	Verify the applicant has a program to address aircraft inactivity and specifies specific maintenance actions for return to service per the applicable MB-326 inspection schedule (for example, after 31 days). The aircraft should be housed in a hangar during maintenance. When the aircraft is parked in the open, it must be protected from the elements, that is, full blanking kit and periodic anti-deterioration checks are to be carried out as weather dictates.	
45.	Specialized Tooling for MB-326 Maintenance	Verify adequate tooling, jigs, and instrumentation are used for the required periodic inspections and maintenance per the MB-326 maintenance manuals.	
46.	Technical Orders Issued While in Service	Verify the AIP references and addresses the applicable NATO/RAAF/SAAF TOs issued to the MB-326 during military service to address airworthiness and safety issues, maintenance, modifications, updates to service instructions, and operations of the aircraft.	
47.	Time Critical Technical Orders (TCTOs) or NATO/RAAF/SAAF Equivalent	Verify the AIP specifically accounts for, addresses, and documents the applicable TCTOs issued to the MB-326, while in service. Compliance with the TCTOs is essential for safe operations. If the AIP only makes reference to a few TCTOs issued in 1976, for example, it would not be adequate.	
48.	NATO/RAAF/SAAF MB-326 Safety Supplements	Verify the applicant/operator has copies of the applicable safety supplements for the MB-326 and they are incorporated into the AIP or operational guidance as appropriate. The most current version of the Airplane Flight Manual (AFM) (or "-1", the TO number for AFM) usually provides a listing of affected safety supplements and this can be used as a reference.	

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49.	Corrosion Due to Age and Inadequate Storage	Evaluate adequacy of corrosion control procedures. Age, condition, and types of materials used in the MB-326 may require some form of corrosion inspection control. Ask whether a corrosion control program is in place. If not, ask for steps taken or how it is addressed in the AIP. Recommend the use of TO 1-1-691, Corrosion Prevention and Control Manual. Note: A 2000 Italian Air Force report identified galvanic corrosion on the MB-339 between Mg (Magnesium) Alloy Trim and Aluminum rivets. See Colavita, M. Chemistry Dept. of CSV, Italian Air Force. Occurrence of Corrosion in Airframes. RTO AVT Lecture Series on "Aging Aircraft Fleets: Structural and Other Subsystem Aspects," November 2000.	
50.	Wing Structural Failure (Fatigue)	MB-326 wings have failed in flight causing fatal accidents. Verify the applicant/operator is aware of the wing structural problems encountered by the RAAF in 1990 when inspection of the MB-326 fleet found serious structural deficiencies that could not be cured by reinforcing the structure but necessitated new wings. The aircraft's AIP must address this issue.	
51.	Italian Air Force MB-326 Aging Aircraft: In Service Experience Report	Verify the AIP addresses the issues, including inspections, describe in <i>Aging Aircraft: In Service Experience on MB-326</i> . Chemical-Technological Department of DASRS – Italian Air Force, RTO MP-18, October 1998. This report provides a very good baseline to ascertain the condition of the aircraft in terms of fatigue and structural integrity.	
52.	Viper Engine Maintenance Procedures	Verify the AIP adheres to the NATO/RAAF/SAAF/Rolls-Royce maintenance procedures requirements.	
53.	Manufacturer's and/or NATO/RAAF/SAAF Engine Modifications	Verify the AIP addresses the incorporation of the manufacturer's and NATO/RAAF/SAAF modifications to the Viper engine installed. The NTSB and some foreign civil aviation authorities (CAA) have determined a causal factor in some accidents is the failure of some civil operators of former military aircraft to incorporate the manufacturer's recommended modifications to prevent engine failures.	
54.	Cycles and Adjustment Viper Engine Replacement Intervals	Ask if both engine cycles and hours are tracked. If not, recommend it be done.	
55.	Viper Engine Inspections and Time Between Overhaul (TBO)	Verify the applicant has established the proper inspection intervals and TBO/replacement interval for the specific engine type (Viper Mark 22-11 engine, Viper 11, and serial number) and adhere to those limitations and replacement intervals for related components. Justification and FAA concurrence is required for an inspection and TBO above those set in the appropriate MB-326/engine inspection guidance. Clear data on TBO/time remaining on the engine at time of certification is critical as is documenting those throughout the aircraft life cycle.	
56.	Engine Thrust	Verify the AIP includes measuring actual thrust of the engine and tracking engine operating temperatures.	
57.	Use of Different Fuels	Verify the AIP addresses how the use of different fuels may require changes or additions to the Viper engine inspection and maintenance programs.	
58.	Engine Ground Run	After engine reassembly, verify the engine goes through a ground run and check for leaks. Confirm it achieves the required revolutions per minute for a given exhaust gas temperature (EGT), outside air temperature, and field elevation.	
59.	Fire Detection System	Verify the serviceability of the fire detection system.	
60.	Servicing, Engine Fire Servicing Personnel Unfamiliar With the MB-326 Create Hazardous Situations	Verify the operator warns servicing personnel via training and markings of the fire hazard of overfilling oil, hydraulic, and fuel tanks. Lack of experience with MB-326 servicing is a safety concern. Require supervision of servicing operations and fire safety procedures.	
61.	Fire Guard	Verify maintenance, servicing, preflight, and post-flight activities include fire guard precautions.	
62.	Engine Start	Verify the AIP includes procedures for documenting all unsuccessful starts.	

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63.	Engine Storage	Review Viper engine storage methods and ascertain engine condition after storage. Evaluate calendar time since overhaul. For example, the use of an engine with 50 hours since a 1991 overhaul may not be adequate and a new overhaul may be required after a specified time in storage. Note: The FAA's position on experimental exhibition of former military aircraft is that engines that have exceeded storage life limits are susceptible to internal corrosion, deterioration of seals and coatings, and breakdown of engine preservation lubricants.	
64.	Engine Foreign Object Damage (FOD)	Verify adoption of an FOD prevention program (internal engine section, external, and air intake). Use air intake covers designed for the MB-326.	
65.	Engine Condition Monitoring	As part of the engine maintenance schedule, recommend an engine Spectrographic Oil Analysis Program (SOAP) be implemented with intervals of less than 15 hours. If baseline data exists, this can be very useful for failure prevention. If manufacturer baseline data does not exist, this may still warn of impending failure.	
66.	BFCU Failure and Inspection	Verify that the AIP addresses the potential for BFCU (Barometric Flow Control Unit) failure, which can result in an engine fire. Recommend inspection each 2 months. See Docket No. 98-ANE-06-AD; Amendment 39-10940; AD 98-25-14 Rolls-Royce Viper Mk. 521, 522, 526 and 601 Series Engines, discussing several known safety issues, including BFCU failure.	
67.	Broken Systems (Fuel, Oil, and Hydraulic) Lines	Verify the AIP includes procedures for inspecting and replacing fuel, oil, and hydraulic lines according to the applicable NATO/RAAF/SAAF requirements; for example, MIL-DTL-8794 and MIL-DTL-8795 specifications.	
68.	Systems Functionality and Leak Checks	Verify procedures are in place to check all major MB-326 systems in the aircraft for serviceability and functionality. Verify the leak checks of all systems are properly accounted for in the AIP per the NATO/RAAF/SAAF requirements.	
69.	Oil, Fuel, and Hydraulic Fluids	Verify procedures are in place to identify and use a list of equivalents of materials for replacing oil, fuel, and hydraulic fluids. A good practice by many operators is to include a cross-reference chart for NATO and U.S. lubricants as part of the AIP.	
70.	Electrical System and Batteries	Verify functionality of the generator and the compatibility of the aircraft's electrical system with any new battery installation or other system and component installation or modification. Avoiding overload conditions is essential because this is a known problem with the aircraft's electrical system.	
71.	Borescope Engine	Recommend the AIP incorporate borescope inspections of the engine at 50 hours per the applicable inspection procedures. AC 43.13-1 can be used as a reference.	
72.	Pitot/Static, Lighting, and Avionics and Instruments	Verify compliance with all applicable 14 CFR requirements (that is, § 91.411) concerning the pitot/static system, exterior lighting (that is, adequate position and anti-collision lighting), transponder, avionics, and related instruments.	
73.	Oxygen System	Emphasize the inspection of the oxygen system and any modifications. Compliance with § 91.211, Supplemental Oxygen, is required. Recommend adherence to 14 CFR § 23.1441, Oxygen Equipment and Supply. Moreover, per FAA Order 8900.1, change 124, chapter 57, Maintenance Requirements for High-Pressure Cylinders Installed in U.S. Registered Aircraft Certificated in Any Category, each high-pressure cylinder installed in a U.S.-registered aircraft must be a cylinder manufactured and approved under the requirements of 49 CFR, or under a special permit issued by the Pipeline and Hazardous Materials Safety Administration (PHMSA) under 49 CFR part 107. There is no provision for the FAA to authorize "on condition" for testing, maintenance, or inspection of high-pressure cylinders under 49 CFR (PHMSA).	

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74.	Other High-Pressure Cylinders	Emphasize the proper inspection of any other high-pressure cylinders installed in the aircraft, that is, fire bottles and nitrogen gas (N2). As per FAA Order 8900.1, change 124, chapter 57, Maintenance Requirements for High-Pressure Cylinders Installed in U.S. Registered Aircraft Certificated in Any Category, each high-pressure cylinder installed in a U.S.-registered aircraft must be a cylinder manufactured and approved under the requirements of 49 CFR, or under a special permit issued by the PHMSA under 49 CFR part 107. There is no provision for the FAA to authorize “on condition” for testing, maintenance, or inspection of high-pressure cylinders under 49 CFR (PHMSA). For example, the fire bottles are time-sensitive items, and may have a limit of 5 years for hydrostatic testing. The issue is when the bottles are removed from the aircraft. It is industry knowledge that non-U.S. bottles may be installed as long as they are within their hydrostatic test dates. A problem arises when removing the bottles for hydrostatic testing. Maintenance programs require these bottles to be hydrostatic tested. Once the non-U.S. bottles are removed from the aircraft, they are not supposed to be hydrostatic tested, recharged, or reinstalled in any aircraft. Moreover, those bottles cannot be serviced (on board) after the testing date has expired.	
75.	Anti-G Suit System	If installed, verify its serviceability.	
76.	Cockpit Instrumentation Markings	Verify all cockpit markings are legible and use proper English terminology and acceptable units acceptable to the FAA.	
77.	Pressurization Vessel	Verify the AIP incorporates the inspection of the pressurized sections of the aircraft (cockpit), noting pressure cycles, and any repairs in the area.	
78.	MB-326 Safety Markings and Stenciling	Verify appropriate safety markings required by MB-326 technical manuals (that is, stenciling and “Remove Before Flight” banners) have been applied and are in English. These markings provide appropriate warnings/instruction regarding areas of the aircraft that could be dangerous. These areas include intakes, exhaust, air brakes, and ejection seats. In the case of ejections seat systems, and as noted in FAA Order 8130.2, paragraph 4074(e), “a special airworthiness certificate will not be issued before meeting this requirement.”	
79.	Incorrect Hardware	Verify the AIP incorporates the use of the correct hardware, for example, bolts. This must be emphasized in all civil operations because (1) original hardware may be difficult to acquire and (2) some aircraft may incorporate the non-approved items today.	
80.	Cockpit FOD	To preclude inadvertent ejection, flight control interference, pressurization valves clogging, and other problems, verify the AIP addresses thorough inspection and cleaning of the cockpit area. This is a standard NATO/USAF/U.S. Navy practice.	
81.	Tires and Wheels	Verify use of proper tires and/or equivalent substitutes (including inner tubes) and adherence to any tire limitation, such as allowed number of landings, inflation requirements, and the use of retreaded tires. The type of tire may dictate the number of landings. Wheels must be properly and regularly inspected and balanced.	
82.	Explosives and Propellants	In addition to verifying manufacturer and service (NATO/RAAF/SAF/USAF) requirements are followed, check compliance with applicable Federal, State, and local requirements for explosives and propellants in terms of use, storage, and disposal.	
83.	MB-326 In-Flight Canopy Separation	Because there is a history of in-flight canopy separation with the MB-326, including fatal accidents, the AIP should address the proper maintenance of transparencies and canopy locks. Monitoring and inspection of the canopy for crazing should be conducted every 10 hours of flight.	
84.	Canopy Seals	Test canopy seals for leaks (that is, use ground test connection).	
85.	Emergency Canopy Jettison Mechanism	Verify the AIP includes testing the MB-326 emergency canopy jettison mechanism. It must be functional and properly inspected per the applicable technical guidance. Note: The original canopy actuators were a major problem, and it was found that pilots could neither release nor jettison the canopy in an emergency situation.	
86.	Brake System	Emphasize a detailed inspection of the brake assemblies, adhere to manufacturer’s inspection guidelines and replacement times, and consider more conservative inspections. Recommend brake inspection at 20 to 30 landings.	

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87.	External Fuel Tanks	Verify the type, condition, installation, and removal of drop tanks meet requirements of the manufacturer or military operator. Only external tanks cleared for use by the aircraft manufacturer, RAAF or SAAF may be used on the aircraft. The only modification allowed to the external tanks is to prevent jettisoning. Accidental jettisoning of the tanks is a safety hazard. Any means of releasing the tanks during aircraft operation must be disabled.	
88.	Hoses and Cables	Inspect and replace hoses and cables appropriately.	
89.	Grounding	Verify adequate procedures are in place for grounding the aircraft.	
90.	Antennae	Verify any original antennas are compatible with all installed electronics. Note: Some new avionics may impose airspeed limitations.	
91.	Transparencies Problems	Ensure proper transparencies maintenance for safe operations. Monitor/inspect canopy for crazing every 10 hours of flight.	
92.	Hard Landings and Over G Situations	Verify hard landing and over-G inspection programs are adopted. This is especially important when acrobatics are performed or when the aircraft is involved in military support missions outside the scope of its experimental certificate (that is, public aircraft operations).	
93.	Parts Fabrication	Verify engineering (that is, Designated Engineering Representative (DER)) data supports any part fabrication by maintenance personnel. Unfortunately, many modifications are typically made without adequate technical and validation data. AC 43.18, Fabrication of Aircraft Parts by Maintenance Personnel, may be used for guidance.	
94.	Wing and Tail Bolts and Bushings	Ask about inspections and magnafluxing of these items. Recommend the AIP incorporate other commonly used and industry-accepted practices involving non-destructive inspection (NDI) if not addressed in the manufacturer's maintenance and inspection procedures.	
95.	Flight Control Balancing and Deflection	Verify flight controls were balanced per the maintenance manual(s) after materials replacement, repairs, and painting. Verify proper rigging and deflection. In several former military aircraft, damage to flight controls has been noticed when inadequate repairs have been performed. If there are no adequate records of the balancing of the flight controls, the airworthiness certificate should not be issued.	
96.	Aileron Deformation, Failure, and Jamming	Because air loads can result in aileron deformation and structural failure, carefully inspect the aileron before and after each flight and adequately address it in the AIP. Note: MB-326 have has instances of aileron control being jammed during aerobatics.	
97.	Air Brake	Verify proper condition, deflection, and warning signage.	
98.	Accurate Weight & Balance (W&B)	Review original W&B paperwork. Verify adherence to NATO/RAAF/SAAF guidance, as well as FAA-H-8083-1, Aircraft Weight and Balance Handbook, if documentation by the applicant appears to be inadequate. Several former military aircraft accidents have been linked to center of gravity miscalculations.	
99.	"Experimental" Markings	Verify the word "EXPERIMENTAL" is located immediately next to the canopy railing, on both sides, as required by § 45.23(b). No subdued markings.	
100.	N-Number	Verify the marking required by §§ 45.25 and 45.29(b) concerning the registration number (N-number), its location, and its size are complied with. If non-standard markings are proposed, verify compliance with Exemption 5019, as amended, under regulatory Docket No. 25731.	
101.	Type of Ejection Seat System	Identify the type of ejection seat fitted to the aircraft. The type of seat changes many aspects of operations and maintenance. For example, MB-326s are typically equipped with the Martin-Baker Mk. 4, which the manufacturer continues to support. Different variants may exists and compliance with the applicable TOs must be ensured.	

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102.	Ejection Seat System Maintenance	Ensure maintenance and inspection of ejection seat and other survival equipment is performed in accordance with the RAAF or SAAF procedures or U.S./NATO applicable TOs by trained personnel. Include specific inspections and recordkeeping for pyrotechnic devices. Ejection seat system replacement times must be adhered to. No "on condition" maintenance may be permitted for rocket motors and propellants. Make the distinction between replacement times, that is, "shelf life" vs. "installed life limit." For example, a 9-year replacement requirement is not analogous to a 2-year installed limit. If such maintenance documentations and requirements are not available, the seat must be deactivated.	
103.	Ejection Seat Components Life-Limit	The life-limits requirements concerning the ejections must be followed. No deviations or extensions should be permitted. In a 2012 finding concerning a 2009 former military aircraft fatal accident, in which the pilot was killed because the ejection seat malfunctioned, it was found that "the ejection seats explosive cartridges were found to be overdue at the time of the accident. The install life and shelf life interval of the cartridges expired. The evidence found indicated that the cartridges were installed on the ejection seat for approximately 8 to 10 years at the time of the accident. The install life was approximately 5 to 8 years overdue and well over the total in service life limit."	
104.	Ejection Seat System Maintainers Training	Require adequate ejection seat training for maintenance crews. On May 9, 2012, an improperly trained mechanic accidentally jettisoned the canopy of a former military aircraft while performing maintenance and was seriously injured.	
105.	Ejection Seat Modifications	Do not permit ejection seat modifications unless directly made by the manufacturer.	
106.	Ground Support Equipment Maintenance	Verify the AIP provides for the proper maintenance of all required ground support equipment.	

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MB-326 Operating Limitations			
107.	AIP and Related Documentation	As part of the operating limitations, require adherence to the AIP and related documentation.	
108.	Understanding of the Operating Limitations	Require the applicant to sign the Acknowledgment of Special Operating Limitations form.	
109.	MB-326 Pilot in Command (PIC) Requirements	As a matter of policy, the FAA requires a pilot have a total of 1,000 hours before they can be issued an authorization to act as PIC of an experimental jet unless they were trained by the U.S. military as a jet pilot. Refer to the appropriate plot training and checking requirements are in FAA order 8900.1, Volume 5 Chapter 9, Section 2. Also recommend a minimum of 10 to 15 hours of dual training in preparation for pilot authorization flight check. Recommend proficiency and currency of 3 hours per month and five takeoffs and landings. Note: The USAF restricted to two the number of aircraft types a pilot could hold currency on.	
110.	Flight Manuals	Ensure the PIC operates the aircraft as specified in the most current version of the flight manual (NATO/RAAF/SAAF manuals -1) for the MB-326 version being flown. Note: An Italian AF MB-326 manual is not suitable for operations of an ex-RAAF or ex-SAAF MB-326.	
111.	Flight Servicing Certificate	Recommend a Flight Servicing Certificate or similar document be used by the ground crew (that is, crew chief or plane captain) to attest to the aircraft's condition (that is, critical components such as tires) before each flight to include the status of all servicing (that is, liquid levels, fuel levels, hydraulic fluid, and oxygen).	
112.	Adequate Annual Program Letter	Verify the applicant's annual program letter contains sufficient detail and is consistent with applicable regulations and policies. (Many applicants/operators submit inadequate and vague program letters and fail to submit them on an annual basis.) Also verify the proposed activities (for example, an air show at a particular airport) are consistent with the applicable operating limitations (for example, avoiding populated areas) and do not pose a safety hazard, such as the runway being too short. Refer to http://www.warbirds-eaa.org/forms/ .	
113.	MB-326 Flight Manual Warnings, Cautions and Notes	Consider requiring review (before flight) of all MB-326 flight manual warnings, cautions, and notes.	
114.	RAAF, SAAF Aircraft Particularities and Restrictions	If the aircraft is an ex-RAAF or SAAF MB-326, verify whether it includes aircraft-specific restrictions in the form of "flight permit" and/or "difference data sheet" restrictions. If those restrictions exist, the operator must understand those restrictions before flight, especially any post-restoration flight.	
115.	Wing Limitations (Fatigue)	Because of the aircraft potential for wing structural problems, recommend that flight limitations in terms of G be considered in conjunction with the AIP and take into account the operating limitations imposed by the RAAF in the 1990s.	
116.	Maintenance and Line Support	Verify the aircraft is operated with qualified crew chief/plane captains especially during preflight and post-flight inspections as well as assisting the PIC during startup and shutdown procedures. Note: A crew chief (USAF) or plane captain (U.S. Navy) is the person (a noncommissioned officer) who is in charge of the day-to-day operations, maintenance, and ground handling of an aircraft.	
117.	Ejection Seat System PIC Training	Require adequate ejection seat training for PIC and crew, if applicable, for the type of seat installed. Note: The record shows the safety record of attempted ejections in civilian former military aircraft is very poor, typically indicating poor training leading to ejections outside of the envelope. The ejection envelope is a set of defined physical parameters within which an ejection may be successfully executed. It is primarily an interaction of two independent sets of parameters: the physically designed characteristics of the particular ejection system and the dynamics of the aircraft flight profile at the moment of ejection.	

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118.	Ejection Seat System Ground Safety	Verify the safety of ejection seats on the ground. Verify ejection seats cannot be accidentally fired, including prohibiting untrained personnel from sitting on the seats.	
119.	Ejection Seat System Safety Pins	Require the PIC to carry the aircraft's escape systems safety pins on all flights and high-speed taxi tests.	
120.	Parachutes	Comply with § 91.307, Parachutes and Parachuting. This regulation includes parachute requirements (1) that the parachute be of an approved type and packed by a certificated and appropriately rated parachute rigger, and (2) if of a military type, that the parachute be identified by an NAF, AAF, or AN drawing number, an AAF order number, or any other military designation or specification number. The parachute must also be rated for the particular ejection seat being used.	
121.	Engine Operating Limits	Adhere to all engine limitations in the applicable NATO/RAAF/SAAF flight manuals.	
122.	Spool Down Time	Verify that the AIP incorporates action(s) following a change in the spool down time of the Viper engine after shutdown. This is critical as it could be an indicator of an upcoming problem with the engine.	
123.	External Stores	Prohibit the installation of external stores to the wing that were not approved by the manufacturer or the military operator. Examples include ECM and travel pods. No external stores may have an in-flight release mechanism. In FAA Order 8130.2, only aircraft certificated for the purpose of R&D may be eligible to operate with functional jettisonable external fuel tanks or stores.	
124.	Restrict Acrobatics	Restrict acrobatics per the appropriate flight manual.	
125.	Mach Meter and Airspeed Calibration	Require the installation and calibration of a Mach meter or verify the PIC makes the proper Mach determination before flight. Unless the airspeed indicator(s) is properly calibrated, transonic range operations may have to be restricted.	
126.	Accelerometer	Ensure the aircraft's accelerometer is functional. This instrument is critical to remain within the required G limitation of the aircraft.	
127.	High-Speed Controllability	Recommend limiting transonic operations by 10 percent below MMO. This provides a good safety margin and could be addressed in the operating limitations, the AFM, and related standard operating procedures (SOP).	
128.	Phase I Flight Testing	Recommend that, at a minimum, all flight tests and flight test protocol(s) follow the intent and scope of acceptable RAAF/SAAF/USAF/U.S. Navy functionality test procedures. The aircraft needs detailed Phase I flight testing for a minimum of 10 hours. Returning a high-performance aircraft such as the MB-326 to flight status after restoration cannot be accomplished by a few hours of "flying around." Safe operations also require a demonstrated level of reliability.	
129.	Post-Maintenance Check Flights	Recommend post-maintenance flight checks be incorporated in the maintenance and operation of the aircraft and that TO 1-1-300, Maintenance Operational Checks and Flight Checks, June 15, 2012, be used as a reference.	
130.	Flight Over Populated Areas	Prohibit flights over populated areas, including takeoffs and landings, if the ejection seat is functional. If not, the aircraft may be operated over populated areas for the purpose of takeoff and landing only, and only in Phase II operations. The area on the surface described by the term "only for the purpose of takeoff and landing" is the traffic pattern. For the purpose of this limitation, the term "only for the purpose of takeoff and landing" does not allow multiple traffic patterns for operations such as training or maintenance checks.	
131.	Visual Meteorological Condition (VMC) and Instrument Flight Rules (IFR) Operations	Recommend day VMC operations only. If IFR operations are permitted, prohibit operations in known icing conditions—aircraft is not properly equipped for icing conditions. Comply with § 91.205.	

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132.	Carrying of Passengers §91.319(a)(2)	Prohibit the carrying of passengers (and property) for compensation or hire at all times. For hire flight training is permitted only in accordance with an FAA-issued letter of deviation authority (LODA). FAA LODA policy limits training to pilots eligible for MB-326 experimental aircraft authorization.	
133.	Reduce Vertical Separation Minimums (RVSM)	Prohibit operations above RVSM altitudes (FL290).	
134.	High-Altitude Training	Recommend the PIC complete an FAA-approved physiological training course (for example, altitude chamber). Refer to FAA Civil Aerospace Medical Institute (CAMI) Physiology & Survival Training website for additional information.	
135.	Minimum Equipment for Flight	Ask the applicant to specify minimum equipment for flight and develop such a list consistent with the applicable military guidance (RAAF, SAAF or USAF) and § 91.213.	
136.	Minimum Runway Length	<p>Ensure the PIC verifies, using the appropriate aircraft performance charts (for example, the RSAF “-1-1” Performance Supplement), sufficient runway length is available considering field elevation and atmospheric conditions. To add a margin of safety, use the following:</p> <p><u>For Takeoff</u></p> <ul style="list-style-type: none"> No person may initiate an airplane takeoff unless it is possible to stop the airplane safely on the runway, as shown by the accelerate-stop distance data, and to clear all obstacles by at least 50 ft vertically (as shown by the takeoff path data) or 200 ft horizontally within the airport boundaries and 300 ft horizontally beyond the boundaries, without banking before reaching a height of 50 ft (as shown by the takeoff path data) and after that without banking more than 15 degrees. In applying this section, corrections must be made for any runway gradient. To allow for wind effect, takeoff data based on still air may be corrected by taking into account not more than 50 percent of any reported headwind component and not less than 150 percent of any reported tailwind component. <p><u>For Landing</u></p> <ul style="list-style-type: none"> No person may initiate an airplane takeoff unless the airplane weight on arrival, allowing for normal consumption of fuel and oil in flight (in accordance with the landing distance in the AFM for the elevation of the destination airport and the wind conditions expected there at the time of landing), would allow a full stop landing at the intended destination airport within 60 percent of the effective length of each runway described below from a point 50 ft above the intersection of the obstruction clearance plane and the runway. For the purpose of determining the allowable landing weight at the destination airport, the following is assumed: <ul style="list-style-type: none"> The airplane is landed on the most favorable runway and in the most favorable direction, in still air. The airplane is landed on the most suitable runway considering the probable wind velocity and direction and the ground handling characteristics of that airplane, and considering other conditions such as landing aids and terrain. 	
137.	Runway Considerations	Consider accelerate/stop distances, balanced field length, and critical field length in determining acceptable runway use per Classic Jet Aircraft Association (CJAA) guidance. To enhance MB-326 operations, it is recommended takeoff procedures similar to the USAF minimum acceleration check speed (using a ground reference during the takeoff run to check for a pre-calculated speed) be adopted.	
138.	Jet Exhaust Dangers	Establish adequate jet blast safety procedures per the NATO/RAAF/SAAF Flight Manual.	
139.	Servicing	Ensure the applicant verifies ground personnel are trained for MB-326 operations with an emphasis on the potential for fires during servicing. Prohibit non-trained personnel from servicing the aircraft. Note: Some MB-326s may be instrumented for liters or imperial gallons.	
140.	Ground Support Equipment	Verify all required ground equipment is available and in a serviceable condition.	
141.	Aerial Target Towing	Restrict all towing. Notwithstanding the standard language in the FAA Order 8130.2 limitations concerning towing, the MB-326 is not to be used for towing targets because such operations pose a danger to property and people on the ground and endanger the aircraft.	

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142.	Hot and Pressure Refueling	Prohibit hot and pressure refueling. There are too many dangers with these types of operations.	
143.	Personal Flight Equipment	Recommend the operator use the adequate personal flight equipment and attire to verify safe operations. This includes a helmet, oxygen mask, fire retardant (Nomex) flight suit, gloves (that is, Nomex or leather), adequate foot gear (that is, boots), and clothing that does not interfere with cockpit systems and flight controls. Operating with a live ejection seat requires a harness. Therefore, recommend only an approved harness compatible with the ejection seat be used.	
144.	ARFF Coordination	<p>Coordinate with Aircraft Rescue and Fire Fighting (ARFF) personnel at any airport of landing. A safety briefing should be provided and include:</p> <ul style="list-style-type: none"> • Ejection seat system, overview; • Making ejection seat safe, including location and use of safety pins; • Canopy jettison; • Fuel system, fuel tanks; • Intake dangers, engine shut-off – throttle, fuel, batteries; • Flooding the engine; • Fire access panels; • Hot exhaust ports; • Crew extraction – harness, oxygen, communications, PEC, and • Forcible entry. <p>ARFF personnel should be provided with the relevant sections of the aircraft -1 (AFM) and other appropriate references like Fire Fighting and Aircraft Crash Rescue, Vol. 3, Air University, Maxwell AFB, 1958. There is additional documentation to address the issues associated with the potential crash of an aircraft like the MB-326. An additional reference is <i>NATOPS U.S. NAVY Aircraft Firefighting and Rescue Manual</i>, NAVAIR 00-80R-14, 15 OCTOBER 2003. The Federal Aviation Administration (FAA) maintains a series of Advisory Circulars that provide guidance for Crash Fire Rescue (CFR) personnel. See AC 5210-17B <i>Programs for Training of Aircraft Rescue and Firefighting</i></p>	
145.	ATC Coordination	Coordinate with air traffic control (ATC) before any operation that may interfere with normal flow of traffic to ensure the requirement to avoid flight over populated areas is complied with. Note: ATC does not have the authority to waive any of the operating limitations or operating rules.	

Issue #	Issue(s)	Recommended Review, Action(s), and Coordination with Applicant	Notes, Action(s) Taken, and Disposition
146.	Military/Public Aircraft Operations	<p>Some MB-326 operators may enter into contracts with the U.S. Department of Defense (DOD) to provide military missions such as air combat maneuvering (ACM), target towing, and electronic counter measures (ECM). Such operations constitute public aircraft operations (PAO), not civil operations under FAA jurisdiction. The operator is required to obtain a declaration of PAO from the contracting entity or risk civil penalty for operating the aircraft outside the limits of the FAA experimental certificate. Verify the operator understands the differences between PAOs and operations under a civil certificate. For example, the purpose of an airworthiness certificate in the exhibition category is limited to activities listed in § 21.191(d). Note: The following notice, which was issued by AFS-1 in March 2012, needs to be communicated to the applicant: “Any pilot operating a U.S. civil aircraft with an experimental certificate while conducting operations such as air-to-air combat simulations, electronic counter measures, target towing for aerial gunnery, and/or dropping simulated ordinances is operating <i>contrary</i> to the limits of the experimental certificate. Any operator offering to use a U.S. civil aircraft with an experimental certificate to conduct operations such as air-to-air combat simulations, electronic counter measures, target towing for aerial gunnery, and/or dropping simulated ordinances pursuant to a contract or other agreement with a foreign government or other foreign entity would not be doing so in accordance with any authority granted by the FAA as the State of Registry or State of the Operator. These activities are not included in the list of experimental certificate approved operations and may be subject to enforcement action by FAA. For those experimental aircraft operating overseas <i>within</i> the limitations of their certificate, FAA Order 8130.2, section 7, paragraph 4071(b) states that if an experimental airworthiness certificate is issued to an aircraft located in or outside of the United States for time-limited operations in another country, the experimental airworthiness certificate must be accompanied by appropriate operating limitations that have been coordinated with the responsible CAA <i>before</i> issuance.” For additional information on public aircraft status, refer to 76 FR 16349, Notice of Policy Regarding Civil Aircraft Operators Providing Contract Support to Government Entities (Public Aircraft Operations), dated March 23, 2011.</p>	
147.	TO 00-80G-1 and Display Safety	<p>Recommend the use of TO 00-80G-1, Make Safe Procedures for Public Static Display, dated November 30, 2002, in preparing for display of the aircraft. This document addresses public safety around aircraft in the air show/display environment. It covers hydraulics, egress systems, fuel, arresting hooks, electrical, emergency power, pneumatic, air or ground launched missiles, weapons release (including inert rounds), access panels, antennae, and other equipment that can create a hazard peculiar to certain aircraft.</p>	

Issue #	Issue(s)	Recommended Review, Action(s), and Coordination with Applicant	Notes, Action(s) Taken, and Disposition
MB-326 Aircraft Flight Manual (AFM), SOPs, and Best Practices			
148.	AFM Addendums	Consider additions or restrictions to the AFM. Operational restrictions should be also addressed in the AFM.	
149.	In-Flight Canopy Separation	Revise the pilot checklist and back-seat occupant briefing to emphasize (that is, “warning—caution”) the proper closing of the canopy.	
150.	V _{ne} of 10% Under MMO and Transonic Operations	Recommend limiting transonic operations by 10 percent below MMO. This provides a good safety margin and could be addressed in the operating limitations, the AFM, and related standard operating procedures (SOP).	
151.	Fuel Mismanagement	Require special emphasis on fuel starvation. There are issues with the fuel system, including fuel not feeding from tips, gages, fuel venting, and fuel leaks.	
152.	Speed Limitations Due To Avionics and Other Equipment.	Verify the speed limit of the aircraft. Some MB-326 operators may install certain types of avionics with speed limitations.	
153.	External Tank(s) Failure	Restrict external tanks to only those cleared by the manufacturer. Adhere to the drop tank limitations related to (1) takeoff and landing performance, (2) G limits, (3) airspeed, and (4) fuel in the tanks. There should not be any means of jettisoning these tanks while on the ground or in flight. There should not be any modifications to the drop tanks.	
154.	Specific Range	Recommend SOPs addressing minimum landing fuel. Verify actual aircraft-specific range (nautical air miles traveled per pound of fuel used).	
155.	Bingo and Minimum Landing Fuel	To add a safety margin, and in addition to § 91.151, Fuel Requirements for Flight in VFR Conditions, recommend establishing SOPs addressing minimum landing fuel for IFR operations as provided in § 91.167. In addition, a “Bingo” fuel status (a pre -briefed amount of fuel for an aircraft that would allow a safe return to the base of intended landing) should be used in all flights. Note: Bingo fuel and minimum landing fuel are not necessarily the same in that a call for Bingo fuel and an RTB still required managing the minimum landing fuel.	
156.	Suspected Flight Control Failure	Recommend establishing SOPs for troubleshooting suspected in-flight control failures, that is, specific checklist procedures, altitude, and clear location.	
157.	FAA AC 91-79	Recommend the use of FAA AC 91-79, Runway Overrun Prevention. According to AC 91-79, safe landings begin long before touchdown. Adhering to SOPs and best practices for stabilized approaches will always be the first line of defense in preventing a runway overrun.	
158.	Reporting Malfunctions and Defects	Ask the applicant/operator to report malfunctions and equipment defects found in maintenance, preflight, flight, and post-flight inspection. This would yield significant safety benefits to operators and the FAA.	

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Attachment 4—Additional Resources and Recommendations

Additional Resources

- Accident data (MB-326), especially the data compiled based on RAAF and RAN MB-326 operations.
- *Aging Aircraft: In Service Experience on MB-326*. Chemical-Technological Department of DASRS – Italian Air Force, RTO MP-18, October 1998.
- Australia's CAAP 30-3(0), *Approved Maintenance Organization (AMO) — Limited Category Aircraft*, Civil Aviation Advisory Publication, December 2001. This publication addresses the restoration and maintenance of ex-military aircraft and is an excellent guide for developing adequate aircraft maintenance and inspection programs.
- CAP 632, *Operation of Permit to Fly Ex-Military Aircraft on the UK Register*. This is a comprehensive source of information and guidance on topics like technical requirements, specialist equipment and systems, pilot/crew qualification, operational requirements, records and oversight procedure, and safety management.
- Chamberlain, H. Dean. FAA News, *Armed and Dangerous*, November/December 2003.
- *CJAA Safety Operations Manual*. June 30, 2008.
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- FAA. AC 5220-9, *Aircraft Arresting Systems*.
- FAA. AC 150/5300-13, *Airport Design*.
- FAA. AC 150/5220-22, *Engineered Materials Arresting Systems (EMAS) for Aircraft Overruns*.
- See FEDERAL FIREARMS REGULATIONS REFERENCE GUIDE, ATF Publication 5300.4, Revised September 2005.
- Morris, Greg. EAA Warbirds of America. Warbirds (magazine), *Warbird Airmanship*, March 2009.
- NATO. AFSP-1(A), *Aviation Safety*, March 2007.
- NATOPS. OPNAVINST 3710.7U, *General Flight and Operating Instructions*, 11/23/2009.
- NATOPS. , NAVAIR 00-80R-14, *U.S. Navy Aircraft Firefighting and Rescue Manual*, October 15, 2003.
- NAVAIR 00-80T-109, *Aircraft Refueling NATOPS Manual*, June 15, 2002.
- *Naval Aviation Maintenance Program Standard Operating Procedures (NAMPSOPs)*, chapter 10.
- NAVPERS 00-8-T-80, *Aerodynamics for Naval Aviators*, January 1965.
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- U.S. Department of Defense. Manual 4160.28 (volume 3), *Defense Demilitarization: Procedural Guidance*, June 7, 2011.
- USAF. AFP 127-1 and NAVAIR 00-80T-116-2, *Technical Manual Safety Investigation, Volume II Investigative Techniques*, July 31, 1987.
- USAF TO 1-1-300, *Maintenance Operational Checks and Flight Checks*, June 15, 2012.
- USAF TO 1-1-691, *Corrosion Prevention and Control Manual*.
- USAF TO 1-1A-1, *Engineering Handbook Series for Aircraft Repair, General Manual for Structural Repair*, November 15, 2006.

Recommendations for Review of Prior Actions

- As provided by § 91.415, review the submitted maintenance manual(s) and AIP. Work with the applicant to revise the AIP as needed based on any concerns identified in attachment 2 to this document. For example, a MB-326 AIP can be modified to address or verify—
 - Consistency with the applicable military TOs for airframe, powerplant, and systems to verify replacement/interval times are addressed.
 - All AIP section and subsections include the proper guidance/standards (that is, TOs or Engineering Orders) for all systems, groups, and tasks.
 - No “on condition” for items that have replacement times unless proper technical data to substantiate the change, that is, aileron boost and oxygen regulator.
 - Ejection seat system replacement times are adhered to. No “on condition” for rocket motors and propellants. Make the distinction between replacement times, that is, “shelf life” vs. “installed life limit.”
 - Any deferred log is related to a listing of minimum equipment for flight.
 - Inclusion of document revision page(s).
- Request a detailed program letter from the applicant to verify proposed operations are consistent with the purpose of the airworthiness certificate. For example, there may be a need to review the proposed airports to be used.
- Verify the application for airworthiness does not constitute brokering. Section 21.191(d) was not intended to allow for the brokering or marketing of experimental aircraft. This includes individuals who manufacture, import, or assemble aircraft, and then apply for and receive experimental exhibition airworthiness certificates so they can sell the aircraft to buyers. Section 21.191(d) only provides for the exhibition of an aircraft’s flight capabilities, performance, or unusual characteristics at air shows, and for motion picture, television, and similar productions. Certifying offices must verify all applications for exhibition airworthiness certificates are for the purposes specified under § 21.191(d) and are from the registered owners who will exhibit the aircraft for those purposes. Applicants must also provide the applicable information specified in § 21.193.
- Review any related documents from U.S. Customs and Border Protection and the Bureau of Alcohol, Tobacco, Firearms and Explosives (ATF) for the aircraft. If the aircraft was not imported as an aircraft, or if the aircraft configuration is not as stated in Form ATF-6, it may not be eligible for an airworthiness certificate. There are many cases in which Federal authorities have questioned the origin of former military aircraft and its installed weapon system. Some have been seized. See FEDERAL FIREARMS REGULATIONS REFERENCE GUIDE, ATF Publication 5300.4, Revised September 2005.

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